"If President Reagan could be an actor and become president, maybe I could become an actor. I've got a good pension. I can work for cheap." -Bill Clinton, speaking at a Hollywood fundraiser

"I do not like broccoli. And I haven't liked it since I was a little kid and my mother made me eat it. And I'm President of the United States and I'm not going to eat any more broccoli." -George H. W. Bush
(36 pts.) 1. For **six** out of the next **seven** equations, fill in the products, give the starting materials, or suggest reagents that would perform the desired transformation. Pay attention to details like stereochemistry, regiochemistry, multiple products, and multiple possibilities. Be sure to indicate the **six** that you would like graded, or the first six answers encountered will be graded. (5 pts each)

\[
\text{1) BH}_3\text{-THF} \\
\text{2) H}_2\text{O}_2, \text{KOH, H}_2\text{O} \\
\text{3) MsCl, py}
\]

\[
\begin{align*}
\text{a. } & \quad \text{MsO} \\
\text{b. } & \quad \text{KOEt, EtOH (ONLY)}
\end{align*}
\]

\[
\begin{align*}
\text{d. } & \quad \text{LDA, THF} \\
\text{e. } & \quad \text{CN}
\end{align*}
\]

\[
\begin{align*}
\text{f. } & \quad \text{NaOMe, MeOH} \\
\text{g. } & \quad \text{iPrOH, heat}
\end{align*}
\]
(30 pts) 2. For **two** out of the following **three** reactions, show step-by-step, arrow pushing mechanisms to account for the products shown (other products may be formed, but they need not be shown). Be sure to include all structures, any resonance structures, and all intermediates. (15 pts each)

a. 

\[
\begin{align*}
\text{OH} & \quad \xrightarrow{\text{H}_2\text{SO}_4 \text{ (cat)}} \quad \xrightarrow{\text{H}_2\text{O}} \\
\text{C}_8\text{H}_{16} & \quad \text{C}_8\text{H}_{16} \\
\text{H}_2\text{O} & \quad \text{H}_2\text{O}
\end{align*}
\]

b. 

\[
\begin{align*}
\text{TsO} & \quad \xrightarrow{\text{MeOH}} \quad \text{MeO} \\
\text{C}_8\text{H}_{16} & \quad \text{C}_8\text{H}_{16} \\
\text{MeO} & \quad \text{MeO}
\end{align*}
\]

c. 

\[
\begin{align*}
\text{Br} & \quad \xrightarrow{\text{EtOH}} \quad \text{EtO} \\
\text{C}_8\text{H}_{16} & \quad \text{C}_8\text{H}_{16} \\
\text{EtO} & \quad \text{EtO}
\end{align*}
\]
3. Assistant Beaker was running an $S_N2$ reaction in Muppet Laboratories. Unfortunately, the only resource he had for running an $S_N2$ reaction was the organic laboratory manual from CH 351-352 at Butler University and he followed that protocol. Looking at the reaction below, explain the results Beaker obtained.

\[
\begin{array}{c}
\text{Cl} \quad \text{NaOEt, EtOH, heat} \\
\text{Ph} \quad \text{Con} \quad \text{OEt}
\end{array}
\]

The pure $S$ enantiomer of the product has an optical rotation of -15. The optical rotation Beaker saw for his product was -12.

4. Given the following “roadmap,” give structures for A, B and C. (4 pts each)

\[
\begin{align*}
\text{HOCH}_2\text{CH}_2\text{OH} & \xrightarrow{1) \text{nBuLi, THF}} \xrightarrow{2) \text{Me-Br, DMF}} \text{A}_{\text{C}_9\text{H}_8\text{O}} & \xrightarrow{1) \text{H-Cl (1 eq)}} \xrightarrow{2) \text{Li}^+\text{CCH, THF}} \text{B}_{\text{C}_7\text{H}_{10}\text{O}} \\
& & \xrightarrow{1) \text{Et-MgBr, Et}_2\text{O}} \xrightarrow{2) \text{Br-CH}_2\text{CH}_2\text{CH}_2\text{-Br, DMSO}} \text{C}_{\text{C}_{10}\text{H}_{15}\text{OBr}}
\end{align*}
\]

**HINT:** internal $S_N2$!
(15 pts) 5. Choose one of the following two compounds and synthesize it from alkenes or alkynes of six carbons or less. You may use inorganic reagents and any base you like for deprotonation only, but if carbons are incorporated into the molecule, they must derive from a legal starting material. Use good steps that would give the desired product as the major product.

\[ \text{O} \]

\[ \text{O} \]

(4 pts) **Extra Credit.** Dr. Wilson uses outrageous analogies in class in an attempt to get students to relate to the material. Give an example of one of the analogies and the chemical principal/concept that to which it relates.